AMENDMENT TO THE CLAIMS

IN THE CLAIMS:

Please **CANCEL** claims 15-26 without prejudice or disclaimer;

Please **AMEND** claims 1, 9, 10 and 27; and

Please **ADD** claim 28 as follows.

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A method <u>of optimizing latchup robustness in integrated circuits</u> comprising the steps of:

identifying element density of at least one functional circuit block;

identifying element attributes of elements associated with the at least one functional circuit block;

forming an element density function parameterized from the element attributes; ~~and~~

modifying placement of the at least one functional circuit block relative to other functional circuit blocks based on the element density function to substantially eliminate latching effects in a circuit<u>; and</u>

<u>controlling a global placement of the at least one functional circuit block relative to injection sources in order to optimize chip performance</u>.

2. (Original) The method of claim 1, wherein the element density is at least one of PFET density and NFET density.

3. (Original) The method of claim 2, wherein the modifying placement step includes:

placing the NFET density of a given functional circuit block away from a source of undershoot; and

placing the PFET density of a given functional circuit block away from a source of overshoot.

4. (Original) The method of claim 1, wherein the step of identifying element attributes includes identifying at least one of sensitive to temperature, power, overshoot, undershoot, external sources, injection mechanisms, element pair density and strength and latchup resiliency, orientation and form factor in the at least one functional circuit block and spatial density.

5. (Original) The method of claim 1, further comprising providing decoupling capacitor elements to fill space or add capacitance to eliminate propagation adjacent an injection source to avoid propagation of latchup or soft latchup.

6. (Original) The method of claim 1, wherein prior to the modifying placement step, the method further comprising the steps of determining at least one of:

(i) orientation and placement of an injecting source;

(ii) distance between an ESD element and adjacent region of high pnpn density;

(iii) form factors of the at least one functional circuit block;

(iv) guard ring utilization between adjacent functional circuit blocks;

(v) NPN density--Number of npn per unit area;

(vi) NPN parameter strength (current gain);

(vii) PNP density--Number of pnp per unit area;

(viii) PNP parameter strength (pnp current gain);

(ix) parameterization of the NPN density as a function of strength parameters statistics;

(x) parameterization of the PNP density as a function of the strength parameters statistics;

(xi) PNPN density; and

(xii)PNPN parameter strength.

7. (Original) The method of claim 1, wherein identifying element density of the at least one functional circuit block includes identifying element density at a perimeter of the at least one functional circuit block to determine a surface density function on the perimeter.

8. (Original) The method of claim 1, wherein the modifying placement step includes spacing the at least one functional circuit block apart from the other functional circuit blocks to reduce coupling strength between elements associated therewith.

9. (Currently Amended) ~~The method of claim 1, further comprising the step of~~ A method comprising the steps of:

identifying element density of at least one functional circuit block;

identifying element attributes of elements associated with the at least one functional circuit block;

forming an element density function parameterized from the element attributes;

modifying placement of the at least one functional circuit block relative to other functional circuit blocks based on the element density function to substantially eliminate latching effects in a circuit; and

determining magnitude of latchup sensitivity of a specific circuit by:

$F=ß_{npn}ß_{pnp}/[(I_{DD}+I_{RW}ß_{npn})/(I_{DD}-I_{RW}-I_{RS}(ß_{npn}^{+1})/(ß_{npn}))]$

wherein when (i) F is less than 1, then latchup does not occur and (ii) F>1 then latchup will occur.

10. (Currently Amended) ~~The method of claim 1,~~ A method comprising the steps of:

identifying element density of at least one functional circuit block;

<u>identifying element attributes of elements associated with the at least one functional circuit block;</u>

<u>forming an element density function parameterized from the element attributes; and</u>

<u>modifying placement of the at least one functional circuit block relative to other functional circuit blocks based on the element density function to substantially eliminate latching effects in a circuit,</u>

wherein the element density function includes:

counting independent BP shapes indicating a number of pnp elements thereby determining a number of p diffusions associated with the at least one functional circuit block; and

counting of independent ROX shapes indicating the number of npn elements associated with the at least one functional circuit block.

11. (Original) The method of claim 10, further comprising determining a number of pnpn and npnp elements based on the number of npn elements and pnp elements to determine element density of the at least one functional circuit block.

12. (Original) The method of claim 9, wherein:

a relative distance between a location of an injecting source and a collecting circuit at (i) comprising elements associated with the at least one functional circuit block is designated as a vector R r_i, where an injector is at a vector position R and a collecting structure is at vector position r_i;

a relative distance between the location of a first circuit at (i) and a second circuit (j) of the at least one functional circuit block is designated as a vector $r_i r_j$;

a spatial function is established which is a relative strength of injection source at R at the position (i); and

wherein a function is created where:

(i) if an $N_{pnpn}(F>1)$ of a first chip region is greater than the $N_{pnpn}(F>1)$ of a second chip region then the first chip region is moved farther away from the injection region;

(ii) if the $N_{pnpn}(F<1)$ of the first chip region is greater than the $N_{pnpn}(F<1)$ of the second chip region then the first chip region is moved closer to the injection region; and

(iii) if the $N_{pnpn}(F)=0$ for the first chip region, then the first chip region is move closest to the injection region.

13. (Original) The method of claim 12, wherein an injection current strength is defined as:

$I_{injection}=[I_{inj}(R))/|R-r_i|^2] \exp-\{|R-r_i|(D\zeta)^{1/2})\}$

where I injection=I_{RW},

wherein when the at least one functional circuit block contains elements whose initial state is F>1 after placement of the functional circuit block, the method further includes the steps of:

performing a re-optimization of local elements by changing spacing of well contact and substrate contacts associated with the elements.

14. (Original) The method of claim 12, wherein placement is chosen based on peak temperature at location R.

Claims 15-26 (Canceled).

27. (Currently Amended) A computer program product <u>for optimizing latchup robustness in integrated circuits</u> comprising:

a computer usable medium having computer readable program code embodied in the medium, the computer program product having:

computer program for identifying element density of at least one functional circuit block;

computer program for identifying element attributes of elements associated with the at least one functional circuit block;

computer program for forming an element density function parameterized from the element attributes; ~~and~~

computer program for modifying placement of the at least one functional circuit block relative to other functional circuit blocks based on the element density function to substantially eliminate latching effects in a circuit; and

computer program for controlling a global placement of the at least one functional circuit block relative to injection sources in order to optimize chip performance.

28. (New) The method of claim 1, further comprising at least one of:

predicting a latchup tolerance;

predicting latchup within the at least one functional circuit block;

utilizing latchup as a design placement criteria for global interactions of the at least one functional circuit block relative to another functional circuit block;

identifying a form factor and either spatial densification or layout optimization of the at least one functional circuit block in order to influence propagation of latchup throughout the chip; and

evaluating a global latchup of injector-to-block distance and a functional block latchup functional.